ART. III.—*Notes on Indian Agriculture, as practised in the Western or Bombay Provinces of India; by* ALEXANDER GIBSON, ESQ., *Superintendent of the Botanic Garden at Dapooree.*

Read 15th June, 1844.

I DO not offer these notes for perusal in the idea that they communicate any thing very new, neither do I suppose that from their contents can be elicited any thing likely to be of solid benefit to the more enlightened agriculturist of Great Britain; as little do I fancy that they can possess even a tithe of the interest which must attach to a detailed description of the careful cultivation practised by the industrious Chinese husbandman. Still, I deem it possible, that they may in some points not be destitute of interest:

1st. As showing that the agriculture of India is not altogether of so rude or slovenly a character as it is often supposed to be.

2nd. That many of the means and instruments used, albeit simple, are yet well adapted to attain the end in view.

3rd. That much of what is bad in the husbandry of India, is owing rather to the faulty framework of the social system of the Hindús, than to any natural want of acuteness.

4th. That until the habits of the people as regards their social system, be in some measure changed, little or no alteration in the present routine of practice is to be looked for.

The remarks which have led me to form the above general conclusions, will be found scattered among the details given hereafter. Having premised thus much, I will proceed to notice separately the modes of cultivation of the various Cereal Grains, Legumes, Oil-Plants, &c., in common use.

1st, WHEAT.—Is grown chiefly above the Ghâts in the Dekkan, Kandesh, and the Carnatic; also most extensively in Gujarat, even to the sea border. Farther south, the climate and soil under the Ghâts, do not admit of its being grown. It is also extensively raised in many level table-lands met with before the Ghâts soften down to the flatter plains, and on such high levels the same measure of grain is found to weigh about one-quarter more than a similar quantity raised in the more plain country.

Wheat is universally sown as a crop of the cold season. The land intended for it, however, receives its first preparation either in

November or December of the previous year, or after the first rains in May of the year in which it is to be grown. In Gujarat, this preparation consists in ploughing three or four times with the two bullock plough. A deeper-going instrument is deemed prejudicial as bringing up an inferior sub-soil. In the Dekkan, the land is most generally prepared with the six bullock plough, while in the more southern districts, bordering on and in the Carnatic, a plough of from twelve to sixteen bullocks is in general use, but is not had recourse to in the same land till after a period of twelve years; and often besides a ploughing with the great plough, the land has to be hand-dug to root out the Haryálí grass, so destructive to crops.

The land having been thoroughly broken up and cleared of grass-roots by ploughing, digging and hand-picking, is left to be beaten down by the action of the rainy weather. In September it again undergoes a slight preparation by the knife-harrow, koolas, (kulava?) and on the weather being deemed favourable, the seed is sown by the simple drill harrow of hollow bamboos, converging upwardly into a cup, and spreading below, so as to allow of the lower extremity of each being inserted into a thick and hollow harrow tooth tipped with iron. Rain falling after germination is deemed to lessen the value of the crop, but a few heavy showers after it has attained the height of three inches materially assist its growth. The reason of the idea is sound and apparent.

The land best fitted for this growth is the strong black soil, which may be called our oldest alluvial, dating probably from the period when the world was a mass of lakes; hence, where this black soil is found in greatest quantity the country is a perfect level. In the best tracts of such soil no artificial manure is ever required. The soil itself seems, owing to the predominance of calcareous matter in a state of very minute division, to have the property of converting every leaf-blade and stick which falls, into a substance identical with itself, in a very short space of time. This may be one reason why manure is not required.

Rotation is certainly necessary and universally practised, but not always until two or three crops in succession have been taken from the ground. Wheat is esteemed a very exhausting crop, or as the natives say, "its roots are foolish." A person attempting to take a crop of sugar-cane after wheat, even supposing that he manures largely, is sure to fail. This I have more than once had occasion to see.

In the best black soils, the power of retaining moisture is so great, that a wheat crop sown, will, without the aid of any after-showers,

but simply by the retained moisture and the action of cold air, turn out full. The rationale of this action of the cold I have not heard explained, but the fact as to its materially aiding in the growth of wheat and other grain is universally admitted. Should rain fall after the ear has begun to fill, the effect is most prejudicial, nay, even the prevalence of a southerly wind, which brings with it the moisture of the sea, is hardly less so. The effect of either of these is to produce a red smut with mildew of the ear, so that in an extent of many acres not one hundred pounds of grain may be reaped.

In some seasons, also, rats are epidemically destructive. For instance, in 1834-5, I recollect that in some districts large remissions of revenue had to be given on this account. The wheat once sown requires no farther care until the reaping season. It is then pulled, bundled, and the shares of the village establishment having been duly paid to them, the remainder is trodden out on the threshing floor. The chaff is carefully set apart as a most necessary provision for bullocks, and stored until the season when other provender is scarce. I believe, that but for this chaff, the cultivation of wheat would be by no means so extensive as it is, for the grain is not so certain a crop as some other crops are. It is also a necessary part of rotation.

Of varieties of wheat which I have seen grown in India, the number is six. Of these, may be first mentioned, Bakhshí, also called Daood Khani, in allusion, doubtless, to its northern origin; these two are very nearly related if not identical; both give a superior flour, best fitted for white bread, sweetmeats, &c.; the first is always raised on irrigated land; the second is a dry crop fitted only for the best soil. I find that the produce does not generally exceed twelve hundred pounds per acre, and is most frequently short of this quantity; the price at which these wheats sell is higher than that of other wheats; but it varies according to situation, season, &c., from sixty pounds to ninety pounds per rupee, *i. e.*, it may be said to vary from ten to sixteen shillings per quarter. In Gujarat, however, the produce may be larger than that above-mentioned.

The tax on an acre of the best wheat ground, may in Gujarat amount to eight or ten shillings. In the Dekkan and Carnatic border, the rate of such ground, per acre, will probably vary from two to five shillings under the new survey. Each acre of wheat will, in addition to the grain produce, be expected to yield chaff to the value of two rupees.

The other varieties of wheat are,—

2nd, Kathí. Inferior to the last in colour and quality, but rather superior in quantity of produce.

3rd, Pothí. Inferior to the last, but suited to poorer and even to grey soil if manured.

4th, Kowrí or Khapale, Do. Do.

5th, Tambari. Inferior to all of the above.

6th, Beardless wheat. Not common here, but grain fine. Said to be common at Delhi.

The tax on the land whereon it is raised may not exceed one and sixpence or two shillings.

As to the storing of the crop, this in a tropical climate, where animals of every description abound, is a most essential part of rural economy. The granaries are always underground pits, excavated in sloping places, or places where the sub-soil is hard and dry; these pits are from six to eight feet in depth, closing to a narrow mouth; and having the bottom well puddled with clay, and the sides lined with thick ropes made of the leaves of sugar-cane, or other dry material, twisted; over these, teak or any other large leaves are carefully built as the filling proceeds; and the mouth is closed by grass beaten down and puddled over with earth. The leaves of the Nim-tree are usually put in along with the grain, as they from their bitter quality, have some power in warding off attacks of the weevil or other insects.

In countries where dry grain is much grown, the number of these subterranean receptacles is so great, that an elephant driver will most reluctantly and carefully pilot his animal through the quarter of a city where the grain shops are, from the fear of the hollow ground giving way under the elephant's weight. In a year of scarcity (and fortunately these are becoming less and less common under our Government,) the value of such receptacles is fully felt.

At present prices, a quantity of wheaten flour sufficient for a meal for two natives, may be purchased for about one penny, and as the wages of labour on this side of India, rule at from four to eight shillings per month, it will be obvious that the number of persons who can afford to feed on wheaten flour, is large. The greater proportion, however, of the labouring population seem to prefer as a food, the cereal next mentioned.

Bajri (*Holcus spicat.*)—This grain is a staple of first importance as an article of food for the working classes, and, indeed, many of the higher ranks, especially Mahrattas, prefer Bajri to wheaten bread. It is generally believed to be the best food for a man who has to labour hard.

It is grown extensively in Gujarat, the Dekkan, and Kandesh.

It does not flourish below the Ghâts southward, neither does it appear to be grown in the Carnatic provinces. The soil which best suits it is a brown mould, partly composed of red and partly of black soil; though this be its most choice habitat, it will be found growing in all the coarser varieties of soil up to the merest detritus of trap rock, forming the lower shelves of hills. In the sandy soils forming the borders of the Northern Desert or Run, it will be found growing luxuriantly.

Bajri land is generally ploughed and turned up as soon as possible after November; it is then ploughed and cross-ploughed, and allowed to benefit as much as possible by the action of the sun in the hot weather; after the first heavy rain of June, and from that time until the 20th of July, the final preparation is given by the knife-harrow twice run over the land. Weeds are carefully collected, heaped, and burned in the land, and manure, if procurable, is then spread. The grain is now sown with the common drill sowing machine, and the ground is then smoothed down by the drill machine inverted, and kept down by the weight of one or more men.

When the crop has reached the height of four or five inches weeds and grass are removed, and the plants are clustered up by a light bullock hoe, composed of two pairs of horizontal iron brackets fixed in frames, and at such distance as to sweep the edges of each drill, removing weeds in their progress, and also loosening and turning up the earth before them. The cost of a pair of such hoes may be about one shilling; they are very effectual for the purpose intended.

From this time until the grain has cared no farther care is requisite; should timely showers, usually looked for in August, fail, the crop will probably be abundant; but even should these fail at the appointed season, the plant is very tolerant of long drought; much rain is injurious, particularly in the shallower and sloping soils; in these, the under stratum being nearly impermeable to water, this is accumulated about the roots of the plants and speedily rots them, especially when no manure has been given. In parts of the same field, the manured portion may often be seen to retain a dark and healthy green hue, while the unmanured portions are of a sickly and dying yellow. The grain having been formed, the next care is to preserve it from birds, such as sparrows, parrots, &c. These animals are most destructive, particularly if trees happen to be situated near to the field; when this is the case, it must be watched from sunrise to sunset, and for this purpose members of the peasant's family relieve each other on a stage erected in the field, and with cries, slings, and stones, keep the birds at bay. The grain having ripened, it is stacked to await the peasant's leisure for threshing.

In threshing, the heads are first separated from the stems; this is performed by women, who, if hired, are paid at the rate of six pounds and a half of grain per one hundred bundles or sheaves of the straw thus separated. It has often occurred to me that a small and simple machine, like the model of a loaded guillotine, might be made efficient in chopping off the heads of grain. The chief obstacle to this, would consist in the different lengths of the straws composing a bundle; a machine of this kind would save a vast quantity of manual labour.

The produce of an average crop per acre, will be found to be about six hundred pounds; but in rich districts, such as Gujarat, one thousand pounds will be nearer the quantity.

The straw is in many districts the only resource of the peasant for cattle-forage, and therefore is most carefully stored, but it is very inferior in nutriment to the straw of millet, or Jowari. The amount of straw per acre may be about six hundred bundles, value about one rupee ten annas, or three shillings.

As to the price of the grain itself, I conclude that the ryot can seldom, except in Gujarat, realise a gross product of more than four rupees per acre, and on poor unmanured, watery, or rocky lands about two rupees per acre.

The tax on land fit for Bajri, may be in Gujarat from two to four rupees per acre; in the Dekkan, &c., at least under the new survey, I believe, that one rupee eight annas may be the maximum, and six annas the minimum, giving an average of fourteen annas; the chaff of this grain is not eaten by cattle.

In the poorer soils along with Bajri, is always sown a small Legume (*Hoolga, hullowla*)[1]; this is hardly in flower when the Bajri is taken off; it is left to ripen and may give about one and a half maunds per acre.

In the richer soils, Túr (*Cytisus bajari*), is commonly sown in the alternate rows, and is also left to ripen after the crop of Bajri is taken off.

The selling price of Bajri in the inland districts can be hardly quoted as higher than one hundred and fifty pounds per rupee; since the abolition of transit duties it has been exported to the coast districts in much larger quantities than was formerly the case, and this has had some tendency to equalise prices. It is reckoned as a very sanatory rotation crop; it is also subject to fewer casualties than are most of the other cereal grains. Alone it is not given to horses, being esteemed too heating, but mixed with math (*Phaseolus aconitifolius*), it forms an excellent food.

[1] Mahratí, Hulagá or hulagí: Dolichos biflorus.—*Editor.*

GREAT MILLET (*Holcus sorghum*). MILLET is a grain very extensively cultivated in this Presidency, throughout Gujarat, Kandesh, the Dekkan, and Carnatic, but in the narrow strip of coast composing the two Conkans, it is not suited to climate or soil, and consequently is never raised. In the rich black plains of Gujarat or Kandesh it may often, indeed most generally, be seen twelve feet high; in these black soil districts it is the established rotation crop for cotton and wheat.

The first variety, or red Jowari, is sown immediately after the first fall of rain in June. The land requires little preparation, as it had been in former seasons either prepared by trenching or by ploughing, and freed from all weeds; thus, the only farther preparation necessary in sowing Jowari is to run the knife-harrow several times over it, and afterwards to sow with the drill machine before-mentioned. The plant is afterwards earthed up or weeded with the bullock hoe; watching is required as in the case of Bajri, and unless done by the peasant's family, constitutes a considerable item of the expense of the crop; it ripens in October, and is pulled, stacked, and the ear afterwards separated by manual labour.

The second variety, or White Millet, is sown in the end of August or beginning of September; this is a much lower growing grain than the first, but the ear is greatly larger, fuller, and both grain and straw are superior. The straw of this last contains much saccharine matter, and is wholly consumed in forage; whereas, of the first only the leaves and tender ends are eatable, while the entire stem is rejected by beasts. In quantity of grain this cereal is most productive, two thousand five hundred pounds per acre being a common crop in good soil.

The growth of the second variety is confined to the more inland and open country, particularly to those districts, which from their situation, get showers in October or November, the commencing showers of the Madras monsoon. It is a crop which bears a good deal of wet without injury to the straw, particularly when manure is used; cold has a beneficial action on the filling of the ear, but the least excess of it kills the plant, and this blight takes place chiefly in situations near a running stream, where the cold is a degree or two greater than that of the surrounding country. Should frost occur, which is sometimes the case, whole fields are immediately dried up. It is a beneficent provision of nature that the straw of this grain should most abound in the black soil districts in which cotton is raised, and which are generally destitute of pasture ground.

For the transport of an article so bulky as cotton, large numbers of bullocks are required; the Jowari straw can be afforded at a rate so cheap, as to be accessible to the poorest; the price varies according to situation, season, &c., from four to fifteen rupees per thousand bundles, and the size of these may be judged of by the fact that ten of them form a load for a man. The straw, particularly of the second variety, is very nutritive; it is carefully stored up as a resource in case of a bad season. In Gujarat it is stored in houses; in the Dekkan and Carnatic, I remark that it is preserved simply by overlaying the sloping stacks with clods of the black soil; these are beaten down by the rain into a uniform mass, which forms a hard crust over the stack. This straw is the principal food for elephants and camels in countries where trees and shrubs are scarce.

This cereal is often sown solely for the sake of the straw; this is done in districts where other pasturage is scarce, but where the means of irrigation are abundant; when sown for this purpose, sowing takes place in March, in ground well manured; it is sown very thick, as length of straw and not weight of ear is the object. It ought to be fit to begin cutting by May 15th, and a careful husbandman calculates on having a supply sufficient for his bullocks until the first rank grass of the rains gathers some heart and is fit for food; it is cut green, and the quantity required for daily consumption is cut, and the remainder left standing. In seasons when from deficiency of the early rain forage is scarce, this straw can often be sold standing, at the rate of about fifty rupees per acre.

In a poor country, such as that which forms a large portion of our Dekkan province, where there is almost always an under supply of forage, every fair means should be taken to encourage the extension of a cultivation so essential for the preservation of animals as this. It is therefore with sorrow, I remark, that under the new survey now in progress, a tax on wells; even of the most common description, is being re-imposed. Since the total abolition of well tax in the Poonah zilla which took place about seventeen years ago, the ryots have exerted themselves in vastly multiplying the means of irrigation. We may now look for a complete check to this spirit, and it seems too probable, that even many wells now in use will be thrown up.

The selling price of millet may be quoted as varying from one hundred and forty to one hundred and seventy pounds per rupee. It seems to form the principal food of the inhabitants of large cities, artisans, weavers, and others whose employments are sedentary. A quantity sufficient for two meals may be purchased for about a half-penny.

The roots of the crop of a previous season are thrown into embankments to help in binding together the soil. Every good cultivator constructs such embankments when the soil of his field is at all sloping, and consequently liable to be washed away. Sometimes they are done by the labour of his own household, but more generally under contract with wirdars, a class who travel about the country performing work of this kind.

ELEUSINE CORACANA (*Natcheny, nágali, maud*).—Cultivated principally as a hill grain, but also in the plains. *E. stricta* is the species cultivated in the latter; it is not an article of general culture, but only in garden villages, near and below the Ghâts, where soil is alluvial, and stream water abundant.

The young plants are raised in a bed formed by ash manure; on the ground being thoroughly moistened, which it ought to be by the 10th July, the young plants are taken out and puddled down in the adjacent fields previously prepared by a light plough and harrow. The increase of this grain is very great, in good soil about three thousand pounds per acre; it is a cheap grain; its price may be quoted at from one hundred and fifty to one hundred and ninety pounds per rupee. I believe that the Banyans often refuse it as a return for cash borrowed, a proof of the small value attached to it in proportion to its bulk.

The hill species, *E. coracana*, is a smaller plant and much less productive; it is planted out in July. As the mode of its cultivation is identical with that pursued with the other hill grains (one excepted,) one description may serve for all.

A piece of jungle is cleared of bushes or trees in any of the dry months; the bushes, leaves, and wood, are thickly spread so as to cover the ground intended for the plants; fire is applied in April or May; with the first rainfall seed is sown broadcast. When the plants are sufficiently high, advantage is taken of wet weather to scratch the adjoining ground into furrows, either by hand or a light plough, a person follows in the furrows with a basket of the plants, which are simply dropped in, and left to be brought on by the rain acting on the loose soil. No further care is required, and reaping takes place in October or November.

On account of the broken nature of the ground it is impossible to estimate accurately the quantity of grain obtained from a given portion of soil, but it is certainly less by three-quarters than that obtained from the garden species above alluded to.

Land thus treated is cultivated for four years in the following rotation.

1st. *Eleusine Cor.*, Natcheny.
2nd. Wari, or Kang, (Kangni?) *Panicum Miliare*, and *P. Italicum.*
3rd. Harik, Kodroo, (Kadrava,) *Paspalum scrobiculatum.*
4th. Verbesina, Black Til, an oil plant.

These four crops are considered to exhaust the soil, which is left in fallow for twelve years. The straw of Natchony is indispensable to the Ghát peasant and the Concan cultivator, as a food for their cattle. In those countries the grass, either from the nature of the climate, or the late period at which it is cut, contains little or no nutriment, and cattle fed on it could not labour for any time. The sale of the spare straw is one of the resources of the peasant, and it is largely purchased by the Lingayet and other travelling grain dealers, whose cattle are generally in good condition. The Banjaras again, or Lumans, make no provision of the kind for their cattle, and the consequence is, that of those who come down for salt late in the season immense numbers die.

The straw of the *E. natcheny* is also used for burning bricks when it is intended that these should be large, or of choice quality; it is chopped up and mixed with the brick clay; the effect, of course, is the thorough baking of the brick. The large bricks to be met with in all old buildings of the Mussulman princes of India have been prepared in this way, so that the children of Israel had reason for grumbling in that they were compelled by Pharaoh to make bricks without straw. (*Vide* Exod. c. v.).

As the roots are many, the grain is thrown on embankments in order that the plant, as it grows, may bind together the earth and stones.

Other Hill Cerealia.—Of these, it may be said generally, that the mode of cultivation is as in that last described; that the produce is quite as cheap or cheaper, and is seldom used as food beyond the districts where it is produced. The patch of rice is chiefly looked to as a mean of paying the land-tax, and the cultivator is fortunate if he has a sufficiency of the other grains to last until the following October.

I remark, that this season locusts appear to have alighted only in villages close to the Ghâts, or in the Ghâts, and in many of these the crops have been so completely eaten up, that the villagers have already begun to feed on the stems of the wild plantain-tree, the wild yam, and the more delicate but rarer root of an undescribed umbelliferous plant named "Peenda."

Before concluding, I will advert to the remarkable intoxicating property found in one of these grains, Harik, a *Paspalum* (frumenta-

ceum?) I have had occasion to see a large number of inhabitants of a village simultaneously affected with intoxication, after a meal made from cakes of this flour. Vertigo, a degree of sleepiness and fatuity, rather than active excitement, is the characteristic effect of this grain. The symptoms are sometimes of a character more severe, lasting for seven days and attended with a vomiting of blood; fatal cases it is said sometimes happen, but I have not any case well authenticated; the effect from the grain eaten is not constant. It is most apt to occur when the grain has attained full development owing to late and heavy rain, acting on a highly manured soil.

Its intoxicating property is said to be neutralised by previous steeping in water wherein cow dung has been diffused.

The remedies had recourse to after the effects have taken place are,

1st, A pottage composed of the flour of "Borud," (*Phaseolus mungo*); and 2nd, expressed juice of leaves of "Harsinga," (*Nyctanthes arbor tristis*).

The action of this grain on the human system is well worthy further investigation.